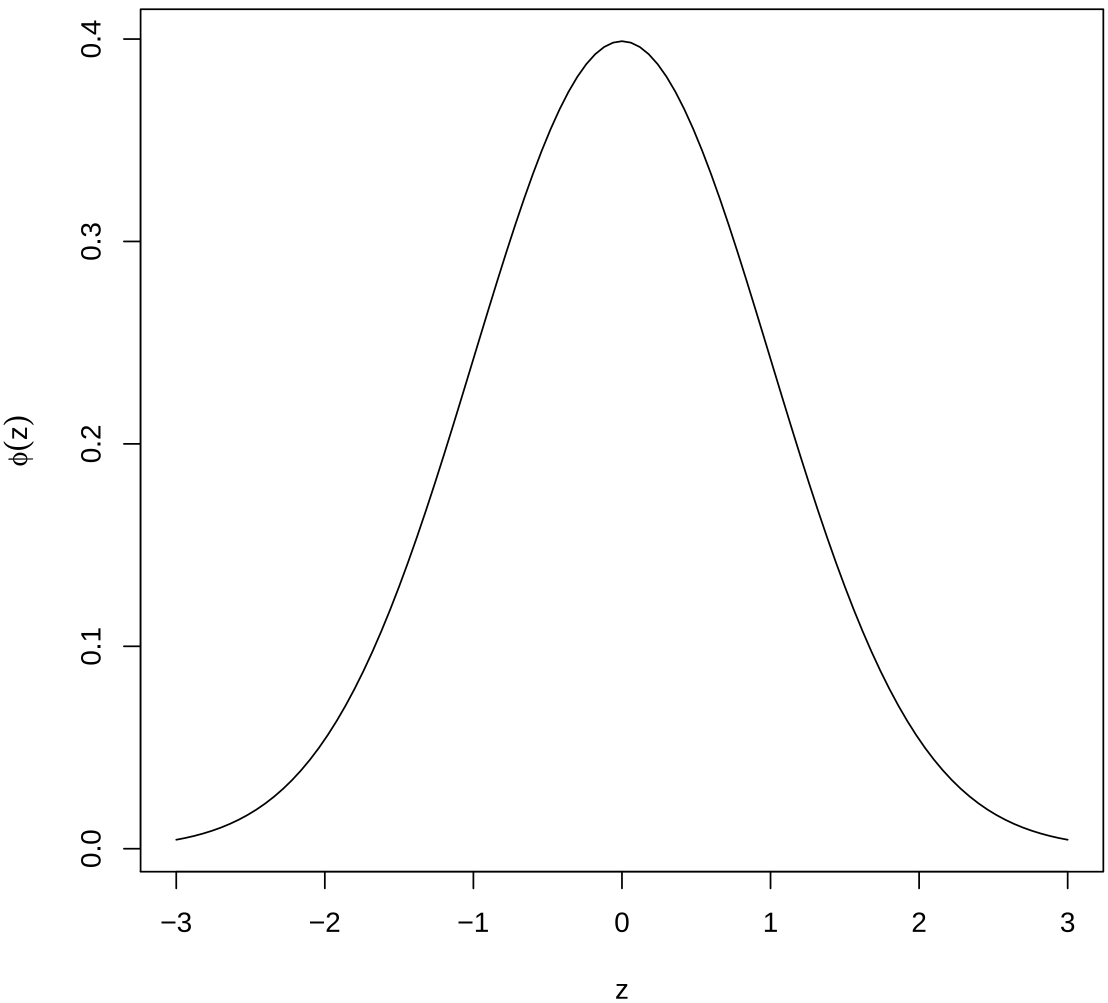
Solutions

1. Use `R` to plot the standard normal pdf, $\phi(z)$, from $z = -3$ to $z = 3$. Be sure to annotate axes in a reasonable manner.

```
curve(dnorm(x,mean=0,sd=1), from=-3, to = 3, ylab=expression(phi(z)),
      xlab="z")
```



2. Use `R` to compute $\Phi(2)$, where we use Φ to denote the standard normal cdf. This is `R`'s "z-table."

```r
pnorm(2)

## [1] 0.9772499
```

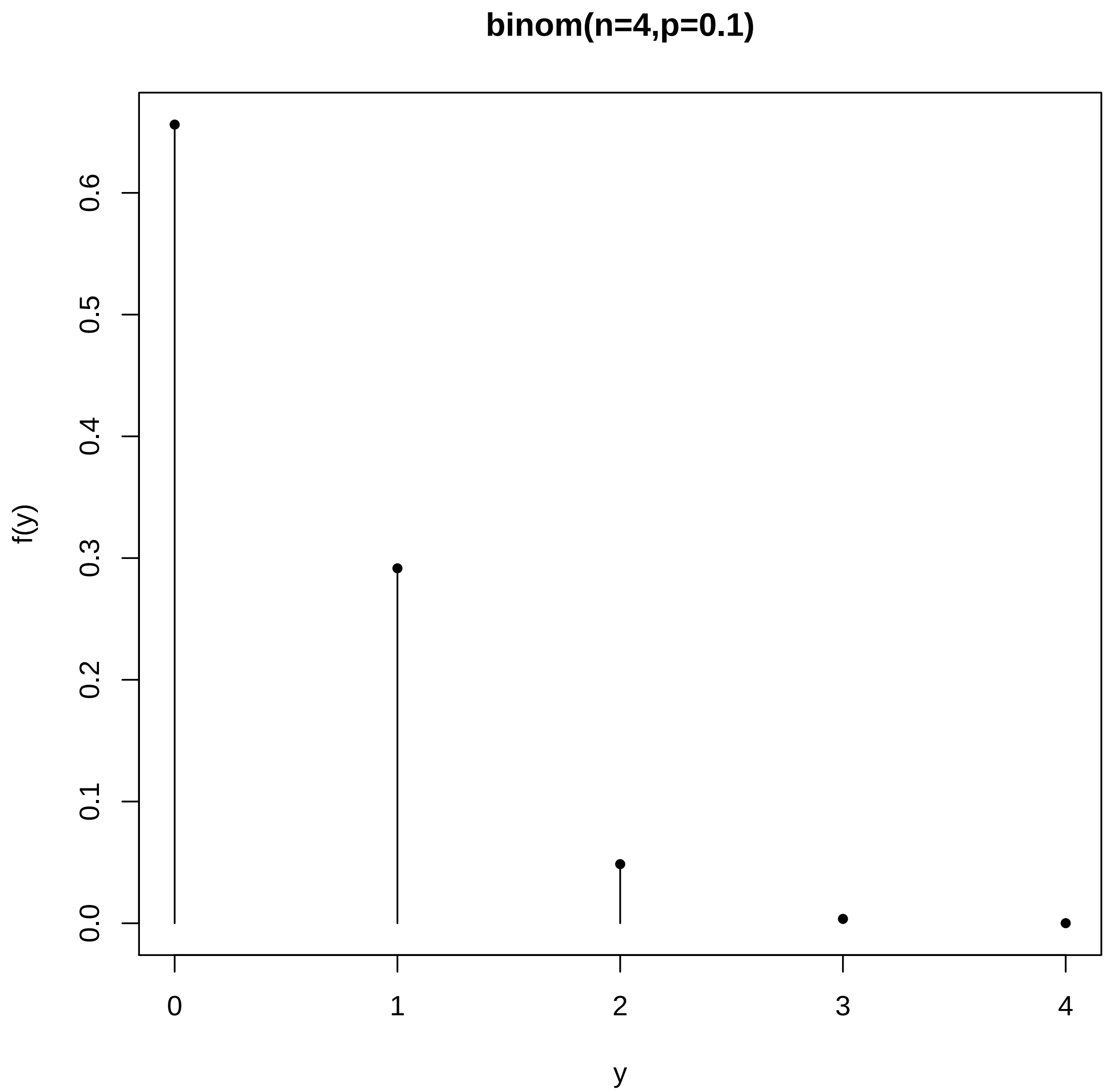
3. Use `R`'s `qnorm` to compute $\Phi^{-1}(0.975)$. We did not discuss inverse cdfs, but we are merely using the inverse function of the standard normal cdf, i.e., using the z-table "in reverse": enter the "table" with a probability to get a quantile (z-value, critical value, etc.) in return. Use `help(qnorm)` for help on using this function. (I mentioned "`pdr`" `R` functions in class. I forgot the "`q`" functions: "`pdqr`" functions.)

```r
qnorm(0.975)

## [1] 1.959964
```

4. Use `R` to plot the binomial pmf with $n = 4$ and $p = .1$. Be sure to annotate plot axes in a reasonable manner.

```r
plot(0:4, binprobs<- dbinom(0:4,size=4,p=0.1), ylab="f(y)", xlab="y",
     pch=20, main="binom(n=4,p=0.1)")
segments(0:4,rep(0,5),0:4,binprobs)
```



5. Use `R` to compute $P(Y \geq 1)$ for $Y \sim binom(4, 0.1)$. Note that the "`p`" functions in `R` give $P(Y \leq y)$ by default. You may use the "`lower.tail=FALSE`" option to get $P(Y > y)$. Note the presence/absence of "=" in "$\leq$" and "$>$": it may make a difference for discrete random variables. You may want to look at `help(pbinom)`.

```
## 1 - P(Y <= 0)
1 - pbinom(q=0,size=4,p=0.1)

## [1] 0.3439

## or 1 - P(Y <= 0.374) (why?)
1 - pbinom(q=0.374,size=4,p=0.1)
```

```
## [1] 0.3439

## or P(Y > 0.5)
pbinom(q=0.5,size=4,p=0.1,lower.tail=FALSE)

## [1] 0.3439

## or P(Y > 0.78594827)
pbinom(q=0.78594827,size=4,p=0.1,lower.tail=FALSE)

## [1] 0.3439

## but not P(Y > 1)
pbinom(q=1,size=4,p=0.1,lower.tail=FALSE)

## [1] 0.0523
```

6. Use `R` to compute $P(Y \geq 0.5)$ for $Y \sim binom(4, 0.1)$.

```
## See above chunk
```

7. Let Y_1 and Y_2 be independent random variables with means (expectations) μ_1 and μ_2 and variances σ_1^2 and σ_2^2.

   (a) What is the mean of $1 + 2Y_1 + 3Y_2$? ANS: $1 + 2\mu_1 + 3\mu_2$. See Remark 3.2 and §3.6 & 3.7 of our notes.

   (b) What is the covariance between Y_1 and Y_2? ANS: 0. See §3.4.2 of our notes.

   (c) What is the variance of the above linear (affine really) combination? ANS: $4\sigma_1^2 + 9\sigma_2^2$. See Remark 3.2 and §3.6 & 3.7 of our notes.

   (d) If Y_1 and Y_2 are normally distributed, what is the distribution of the above linear combination? ANS: normal, with the above mean and variance. See §3.7 of our notes.